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BRIEF COMMUNICATION

Chlorflurenol: Its Effect on Photomorphogenesis in Potato Sprout Growth

A. N. PUROHIT

Central Potato Research Institute, Simla-1, India

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Abstract. Two typical dark-responses namely the excessive elongation of sprouts and the formation of sprout hook, are adversely affected by chloroflurenol. It also affects the polarity of sprouts and the formation of roots on tubers, the effect varying with the concentration and the light condition. The significance of these effects of chloroflurenol used in potato production has been discussed.

Dark responses in potato sprout growth are characterized by (1) excessive growth in length, (2) the formation of "sprout hook" which unbends in the presence of light with about 15 days of lagphase, and (3) the lack of chloeophylls, although anthocyanins are formed in the dark also. In addition to these photosensitive characters, sprouts, irrespective of the light conditions under which they develop, show positive phototropism and produce roots and stolons at each node, although these elongate only when humidity is increased. In the present communication the effect of one of the morphactins (CFI) on the growth behaviour of sprouts under darkness and light has been reported.

Unsprouted cold-stored tubers of *Solanum tuberosum* L. cv. Kufri Sheetman were treated with 0, 1, 5, 10 and 40 mg l^{-1} of chlorflurenol (2-chloro-flurene-*g*-carboxylic acid) for 1, 2 and 4 h. Immediately after the treatment, 10 tubers from each treatment group were kept in darkness and another group of ten tubers in light at 18—20 °C temperature. Tubers in different treatment groups were observed regularly for the emergence of sprouts and subsequently 15 days after the treatment, observations were recorded on different characters. Five tubers from each treatment were kept in closed polyethylene bags to enable the root growth to be seen under higher humidity under light and darkness in different treatments.

TABLE 1

EFFECT OF DIFFERENT CONCENTRATIONS of chlorflurenol on number, mean length, and angle o "sprout hook" under two light conditions. Treatment was given as diptreatment for one hour.

Light condition	Chlorflurenol concentration [mg l^{-1}]			
	0	1	5	10
		Number per tuber		
Light	5.6	9.7	11.7	11.4
Dark	6.7	8.6	8.6	7.9
		Length of sprout [cm]		
Light	2.0	1.3	1.1	1.0
Dark	9.5	4.8	3.1	2.9
		Angle of "sprout hook" [°]		
Light	—	—	—	—
Dark	77.1	98.0	—	—

—: No "hook" formation

Number and Length Sprouts

It was was observed that the number of sprouts per tuber increased with the concentration in the range of 0 to 10 ppm of CFI, the effect being more in light than in darkness (Table 1). No sprouts were produced in 40 ppm treated tubers so this is not included here. The analyses of variance (Table 2) of the data also showed that differences due to concentration, light conditions, interaction between CFI concentration and light conditions were highly significant. The treatment effect also varied with time but the effect was less significant.

The mean length of sprouts per tuber (Table 1) decreased with concentration and the effect was more pronounced under darkness. The differences were highly significant (Table 2b).

TABLE 2

CORRELATION COEFFICIENT for different treatments

Treatment	Characters	
	Number of sprouts	Length of sprout
Between periods of treatment (T)	2.10 N.S.	2.19 N.S.
Between concentration (C)	15.90 **	50.07 **
Between light and dark (Lc)	13.19 **	226.25 **
T × C	2.24 *	3.16 **
T × Lc	3.42 N.S.	2.96 *
C × Lc	5.34 **	27.99 **
T × C × Lc	1.10 N.S.	2.89 *

* Significant at 5 percent level;
** Significant at 1 percent level
N.S. Non significant

Root Formation

It was observed that when tubers treated with different concentrations of CFI were kept under darkness and light in high humidity, roots developed at each node in sprouts in water-treated tubers and the formation of roots was adversely affected by morphactin to such an extent that in higher concentrations roots were completely absent (Figs. 3 and 4).

Hook Formation

The formation of hook was observed only in dark grown sprouts (Figs. 1 and 2). In CFI treated tubers the degree of curvature, as judged from the angle (Table 1) decreased with concentration, so much so that in 5 and 10 mg l^{-1} CFI the curvature was completely absent. It was observed that sprouts in CFI treated tubers grew horizontal under both light conditions in contrast to their vertical growth in the control (Figs. 1 and 2) and this effect also increased with the concentration of CFI.

In the present observations it is seen that two typical light dependent responses of sprout growth in potato, namely the excessive elongation and "hook" formation in the dark are adversely affected by CFI. The adverse effect of CFI on "hook" formation in potato confirms the similar report in *Cardamine chenopodifolia* "hypocotyl hook" by LORENZEN (1968), seen in SCHNEIDER 1970) which indicates that CFI can induce a similar reaction as light does.

The complete abolition of polarity and verticale elongation of sprouts in this case is in agreement with the earlier reports in other plants (for references see SCHNEIDER 1970). The effect of CFI on polarity and "hook" formation has an important bearing on its beneficial use in potato production. In our field and pot experiments with CFI in potato, it has been observed that in unsprouted tubers treated with this chemical before planting, the germination is delayed and is very low and the yield is reduced considerably. If, however, well sprouted (2.3 cm long sprouts) tubers are treated and then planted, the germination is not affected and at the same time the yield is increased significantly (unpublished). It seems that these effects are probably due to the fact that CFI treated unsprouted tubers, even although sprouting does take place, germinations is considerably delayed in the absence of "hook" which helps the sprout to emerge from the soil- and horizontal polarity.

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Figures at the end of the issue.

Reference

SCHNEIDER, G.: Morphactins: Physiology and performance. — Annu. Rev. Plant Physiol. **21** : 499—536, 1970.